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Fabrication and corrosion resistance of phosphate/ZnO multilayer protective coating on magnesium alloy

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Abstract: Zinc phosphate conversion coating was prepared on AZ61 magnesium alloy by using chemical conversion method, and then processed by hydrothermal treatment in solution containing $Zn(NO_3)_2$ and stearic acid. The surface morphologies, chemical characteristics and wettabilities of multilayer coatings were observed and characterized by scanning electron microscopy (SEM), X-ray diffractometer (XRD), Fourier-transform infrared spectrophotometer (FTIR), Raman spectrometer and optical contact angle meter. The corrosion resistance of coatings were determined by polarization curves. Findings show that zinc phosphate conversion coatings on magnesium alloy are in block structure with microcracks and lower corrosion resistance. After hydrothermal treatment, there are few microcracks on the multilayer coating, and the dense ZnO and stearic absorbing layers are grown on conversion coatings with hydrophobic or even superhydrophobic character and higher corrosion resistance. With the increasing of $Zn(NO_3)_2$ concentration in hydrothermal solution, the water contact angle and corrosion resistance in 3.5wt% NaCl solution of multilayer coatings are firstly increased and then decreased. The optimum $Zn(NO_3)_2$ concentration in hydrothermal solution is 0.035 mol/L,